INNOVATING CROSS-DOMAIN SOLUTIONS TO DETECT EMERGING BIOLOGICAL THREATS

Utilization Of Bioprinting To Fabricate Tunable Tissues: A Polymeric Perspective

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Understanding the effects of exposure from both toxic chemicals and biological agents is a cornerstone of research at DEVCOM Chemical Biological center, with current pursuits encompassing the complexity of all human physiological components such as age, ethnicity, and gender. Historically, 2D cell culture has been implemented to understand the effects of such agents on the warfighter, but limitations with this approach have been well documented such as the challenge to translate experimental results to real-life scenarios. Consequently, new techniques have been explored to allow for more translatable data such as animal testing, organ on a chip, and most recently, 3D printing of tissue mimics. There are still limitations with platforms such as animal testing and organ on a chip but bioprinting has emerged to address some of these issues. As 3D printing has taken off into manufacturing and innovation, bioprinting emerged to fabricate 3D scaffolds of cells within a polymer matrix that can be specifically tuned to mimic a wide range of human physiology. This allows for a better model than traditional 2D cell culture as the 3D matrix provides a more realistic model of living tissue. Bioprinting allows for this flexibility as properties such as elasticity and thickness can be changed in the material formulation and printing parameters. To better understand these material formulations and to benefit downstream analysis such as permeation through the 3D construct, polymer properties must be understood. This collaborative effort at DEVCOM CBC focuses on implementing bioprinting as a realistic approach to better understand possible effects on the warfighter. Using an ocular model as the guide, a tissue often not investigated, the formulation and printing parameters highlighted above are explored using various polymers and crosslinkers to better understand gel properties through the printing process and final 3D construct. The resulting printed ocular models are then characterized to determine the similarity to the physiological tissue.

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